

REFERENCE CONDITIONS OF THE RED RIVER FLOODPLAIN AND UPLAND, CADDO PARISH, LOUISIANA

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ABSTRACT

We studied the presettlement woody vegetation of the Red River floodplain and adjacent upland in Caddo Parish, Louisiana, by analyzing the 1830s Government Land Office surveyors' records. We looked for evidence of monospecific pine savanna/forest in the uplands as historical accounts relate and compared the woody vegetation of the floodplain with that of the upland. We found that the upland was a mixed hardwood-pine forest with some areas almost exclusively hardwood, that there were no areas that were monospecific pine forest, and that the upland and floodplain are floristically different. Oak was rare on the floodplain but occurred near prairies lying within the floodplain.

KEY WORDS: Red River, Louisiana, Caddo Parish, floristics, Government Land Office, land plat

RESUMEN

Hemos estudiado la vegetación leñosa previa a la colonización de la llanura de inundación del Red River y las tierras adyacentes en Caddo Parish, Louisiana, analizando los registros de los supervisores del Government Land Office en los años 1830. Hemos buscado pruebas de los bosque/sabana monoespecíficos de pinos en las tierras altas tal como lo relatan las crónicas históricas y se compara la vegetación leñosa de la llanura de inundación con la de las tierras altas. Hemos encontrado que en las tierras altas había un bosque mixto de pino y árboles de madera dura con algunas áreas que casi tienen exclusivamente árboles de madera dura, que allí no había áreas en las que hubiese bosques monoespecíficos de pinos, y que las tierras altas y las llanuras de inundación son florísticamente diferentes. Los robles son raros en la llanura de inundación pero se dan en las praderas próximas a estas llanuras.

INTRODUCTION

The prerequisite to ecological management, conservation, and restoration is knowing what existed in the past (Egan & Howell 2001). There are two main methods of discovering this. The first, and most desirable, is to have some of the original functioning ecosystem left to study. If none of the original remains, or if it is uncertain if any remains, the next recourse is historical records.

Unfortunately, little, if any, of northwestern Louisiana remains in a natural

condition, certainly not large landscapes. Thus, we turned to historical materials to understand the reference conditions of the region. These included accounts of travelers, naturalists, and others, and Government Land Office land surveys. Unfortunately, travelers' accounts are brief and focused. Naturalists did better, but again, the accounts are limited and incomplete (e.g., Freeman and Custis Red River expedition [Flores 1984]). Foresters and others interested in exploitable resources also gave descriptions, but these are often so concerned with a single resource that the overall picture is missing (e.g., Mattoon 1915).

Consequently, we focused on 1830s Government Land Office surveyors' records. Our objectives were to determine, in so far as these sources would allow, 1) whether the upland was pine savanna/forest or mixed hardwood-pine forest, and 2) if and in what ways the floodplain and upland differed in woody vegetation.

RED RIVER FLOODPLAIN AND UPLAND: CADDO PARISH

The Red River originates in the Great Plains of eastern New Mexico and the panhandle of Texas and flows east and southeast until it reaches the Mississippi River in central Louisiana (Fig. 1). Red and brownish-red silt and clay particles, eroded from mainly Paleozoic rock, give the river its distinctive color. It is a sluggish river with a low-lying, flat, extensive Pleistocene/Holocene alluvial floodplain valley five to thirty km wide, with oxbows, sloughs, and backwater swamps. As the glaciers receded and the sea levels rose, the gradient of the river lessened, making it braid and meander widely with resultant deposition of alluvium that we see today (Newkirk & Mueller 1980).

Native American hunters entered the Red River area about 12,000 years ago at the end of the last glaciation, long before the present climate and biota were established. Settled agriculturists along the river probably do not exceed 3000 BP. Their effect on the ecology is not known, but it was probably comparatively minor (Neuman 1984; Ames 1999). The Red River was first seen by European explorers in the sixteenth century. Its lower portion was colonized by the French in the eighteenth century, but because of the Great Raft—hundreds of log jams measuring from a hundred meters to a kilometer in length, damming the river and causing overflow resulting in extensive flooding including the creation of numerous raft lakes adjacent and upstream from the rafts—its upper portions were not explored until the nineteenth century when, in 1806, the Freeman and Custis expedition went through and around the Raft to near the present day border of Oklahoma and Arkansas (Flores 1984). Marcy and McClellan (1854) completed exploring the river in the mid-nineteenth century. The Raft was cleared in two stages between 1833 and 1873, with the result that the extensive raft lakes drained, the river lowered and became navigable, allowing rapid exploitation of the floodplain with the establishment of farms, plantations, towns, and cities (see Talfor 1873; Triska 1984; Bagur 2001 for full description of the rafts and raft lakes).



FIG. 1. Course of Red River and location of Caddo Parish, Louisiana (stippled area).

The topography of Caddo Parish is relatively simple. The Red River alluvium or floodplain covers about 28% of the 2,283 sq. km parish (Fig. 2). It forms a continuous north-south border along the eastern edge of the parish. The floodplain can be very narrow as when the river approaches a bluff, but it is generally several km wide. At the edge of the river are natural levees and swales. Farther inland, the topography rises in a slight terrace. Nonetheless, the landscape is relatively flat. Floodplain elevations range from approximately 60 m at the northern edge of the parish to about 43 m at the southern edge. The overall north-south slope is about 0.28 m per km. Sediments are almost entirely of Red River alluvial origin (Edwards et al. 1980).

Flanking the floodplain at its western edge is the upland. This often involves an abrupt elevation transition generally in the range of 20 to 40 m. The upland is geologically older than the alluvium, generally consisting of Tertiary

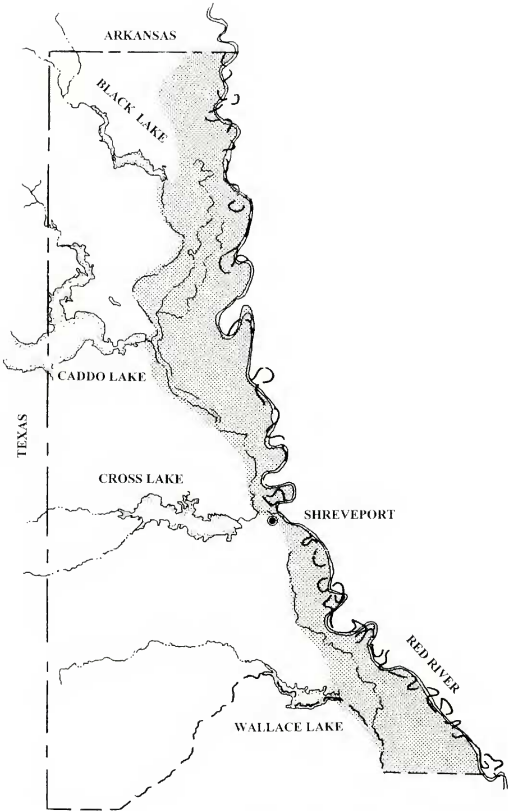


FIG. 2. Caddo Parish (2,283 sq. km) showing Red River, floodplain (stippled), and uplands (not stippled).

deposits. Elevations rise to no more than 137 m, and topography is rolling low hills or relatively flat terraces.

The river, its floodplain, and adjacent upland ecosystems have undergone major modification over the past two centuries. Virtually the entire landscape has been converted to farms and plantations and, more recently, urban sprawl. What once was a continuous savanna/forest with numerous plant communities covering hundreds of thousands of hectares is now virtually gone with only fragments of the natural vegetation remaining and few, if any, in virgin condition. Bald-cypress swamps, black willow riverbank shrublands, and cottonwood forests persist while some floodplain communities such as eastern red-cedar forests, canebrakes, and prairies have vanished entirely (MacRoberts et al. 1997). The upland has also been modified, mainly by urban sprawl, logging, and clearing for farms. Vast areas of forest were clear-cut in the latter part of the nineteenth and early part of the twentieth century.

While floodplains in general have received substantial phytogeographical and ecological attention and there are numerous generalized descriptions and classifications according to hydrologic conditions, soils, and vegetation (e.g., Sharitz & Mitsch 1993; Messina & Conner 1998; Mitsch & Grosselink 2000), the Red River floodplain is poorly known especially floristically (see Newkirk & Mueller 1980). Aside from checklists of parishes and counties along the Red River (e.g., MacRoberts 1979; Thomas & Allen 1993-1998), its last floristic survey was in 1806. The Red River floodplain has never been the subject of an ecological assessment or community study; however, Van Kley and Hine (1998) described the wetland vegetation of Caddo Lake, a raft lake; Ware (1956) briefly described the vegetation on a sand bar near Natchitoches; Teague and Wendt (1994), concentrating on Bossier and Caddo parishes, conducted the first parish-wide comprehensive survey of high quality natural communities in Louisiana, only a few of which turned out to be floodplain communities; and Mundorff (1998) studied bottomland hardwood forests on the Angelina and Neches rivers in east Texas. Dale and Ware (2004) studied wetland tree species in relation to flooding gradient in Arkansas but excluded from their analysis areas dominated by baldcypress, black willow, and cottonwood. Two non-quantified reports round out the list: Palmer (1923) provided an anecdotal report of the Red River forest at Fulton, Arkansas, and the Henderson State University Biology Department (1979) prepared a report for the Army Corps of Engineers that purports to be a "biological inventory of the Red River waterway," but it is of limited value since few details of data collection are provided.

Except in the longleaf pine region of central Louisiana (Bridges & Orzell 1989; Van Kley 1999), the upland in the Red River drainage is no better studied and in general is taken to have been continuous with what characterized the upland of the remainder of the upper West Gulf Coastal Plain: south Arkansas, northeast Texas, and north Louisiana; that is, a mixed pine-hardwood savanna/

forest or a monospecific pine savanna/forest (Teague & Wendt 1994; Carr 2000). Furthermore, there are conflicting historical accounts: were the upland forests dominated by pine, were they sometimes even monospecific pine extending over many hundreds of square km, were they mixed hardwood-pine, or were they a combination of all three (Hilgard 1873, Lockett 1876; Mohr 1898, Mattoon 1915; see reviews in Carr 2000 and Bragg 2002)?

METHODS

1. Bearing tree data. We used the 1830s Government Land Office, Caddo Parish, Tree Book (a summary of the surveyors' notes that gives only the bearing trees to species at each section and quarter section corner, their diameter, and their distance from the corner), surveyors' line notes, and land plats to determine the woody vegetation of Caddo Parish just before Anglo-European settlement. In general, in these surveys four bearing trees were recorded for each section corner and two bearing trees at each quarter section corner. In addition, for each mile, surveyors gave impressionistic "line notes" describing the timber and land quality. Surveyors only used common names, and in many cases were not specific as in the case of hickory, ash, elm, willow, hackberry, locust, and occasionally oak. Nonetheless, using modern information, it is usually possible to determine which species or group of species they meant. Since the limitations of GLO surveys are well known and discussed, little needs to be said here (Delcourt 1976; Whitney & DeCant 2001; Bragg 2002, 2003) except to point out that we analyzed four townships to see if there was bias. We found that there was not (Appendix 1). Using topographic maps, we divided the landscape into upland and floodplain and then entered each bearing tree listed in the Tree Book according to where it occurred on the landscape. The sample involved 5974 trees in the upland and 1805 trees in the floodplain for a total of 7779 trees.

2. Monospecific pine forest. We looked for evidence of monospecific pine savanna/forest in each township by examining the total percentages of various species recorded and, in townships with a high percent of pine recorded, for regional clumping of pine.

3. Roadside surveys. We surveyed both the Red River floodplain and upland by driving highways and backroads between Natchitoches, Louisiana, and the Louisiana-Arkansas border to form an impression of the present day woody vegetation of both. We did not attempt to quantify this aspect of the study. While clearly extensively modified by human activity especially over the last two centuries, it is possible by these surveys to see what species grow in the uplands and floodplain today.

4. Because of the lack of overlap in tree species between uplands and floodplain (see results), we were especially interested in any situation where taxa from one area occurred in the other. We therefore carefully examined areas of the floodplain that had oaks.

RESULTS

1. Bearing tree data. Table 1 lists the Government Land Office bearing tree abundance data for the Red River floodplain and upland for all of Caddo Parish. Surveyors' designations are given as common names; modern interpretations follow in parenthesis. Only taxa with 0.5 percent or higher presence are included.

2. Monospecific pine forest. We found no evidence for monospecific pine savanna/forest. The closest to this condition was in sandy areas in the very northern tier of the parish in T23NR15-16W where pine reached 50 percent of the bearing trees. Nonetheless, even here the surveyors' line notes most commonly read: "oak, hickory, pine & etc." although occasionally "poor rolling pine land," or "poor land oak & pine." There is no mention of the ground cover, and there is no indication in the surveyors' records of pine savanna/forest. Some upland areas had little or no pine, notably T17NR14-15-16W and T19NR15-16W where pine ranged from zero to six percent of the trees and the line notes confirm the absence of pine. Here the notes repeatedly read "oak, hickory." These uplands were oak-hickory woodland/forest.

3. Roadside surveys. Distributed all across the floodplain and often intermixed with one another are ash (*Fraxinus pennsylvanica* Marsh), bald cypress (*Taxodium distichum* (L.) Rich.), boxelder (*Acer negundo* L.), button bush (*Cephalanthus occidentalis* L.), cottonwood (*Populus deltoides* Bart. ex Marsh.), elm (*Ulmus americana* L.), hackberry (*Celtis laevigata* Willd.), honey locust (*Gleditsia triacanthos* L.), mulberry (*Morus rubra* L.), Osage orange (*Maclura pomifera* (Raf.) C.K. Scheid.), pecan (*Carya illinoensis* (Wang.) K. Koch.), persimmon (*Diospyros virginiana* L.), rough-leaved dogwood (*Cornus drummondii* C.A. Mey.), swamp privet (*Forestiera acuminata* (Michx.) Poir.), sycamore (*Platanus occidentalis* L.), and willow (*Salix nigra* Marsh). Chinese tallow (*Sapium sebiferum* (L.) Roxb.) was common and Chinaberry tree (*Melia azedarach* L.) was occasionally encountered. The absence of oak, notably flood-tolerant oaks such as overcup (*Quercus lyrata* Walt.) and willow (*Q. phellos* L.) remains puzzling since we are aware that most southeastern floodplain descriptions have these species (see Sharitz & Mitsch 1993; Messina & Conner 1998; Mitsch & Grosselink 2000).

Our roadside surveys of the upland showed an entirely different woody flora consisting largely of white oak (*Quercus alba* L.), southern red oak (*Q. falcata* Michx.), post oak (*Q. stellata* Wengen.), blackjack oak (*Q. marilandica* Muenchh.), black oak (*Q. velutina* Lam.), shumard oak (*Q. shumardii* Buckl.), bluejack oak (*Q. incana* Bartr.), water oak (*Q. nigra* L.), loblolly pine (*Pinustaeda* L.), shortleaf pine (*Pinus echinata* P. Mill.), sweet gum (*Liquidambar styraciflua* L.), black gum (*Nyssa sylvatica* Marsh), dogwood (*Cornus florida* L.), black hickory (*Carya texana* Buckl.), mockernut hickory (*C. tomentosa* (Poir.) Nutt.), bitternut hickory (*C. cordiformis* Wengen.) K. Koch). Oak and pine dominated.

TABLE 1. Tree abundance data (as percent of total for each landscape) for floodplain and upland based on General Land Office witness trees.

TREES	UPLAND	FLOODPLAIN
Black, Red, and Spanish Oak (<i>Quercus</i> <i>velutina</i> Lam. <i>Q. shumardii</i> Buckl., <i>Q. falcata</i> Michx., <i>Q. texana</i> , Buckl.) <i>Q. pagoda</i> Raf.	31.5	2.7
Pine (<i>Pinus echinata</i> Mill., <i>P. taeda</i> L.)	16.3	
Post Oak (<i>Quercus stellata</i> Wang.)	11.2	0.6
Hickory (<i>Carya texana</i> Buckl., <i>C. tomentosa</i> (Poir.) Nutt., <i>C. cordiformis</i> (Wangenh.) K. Koch)	10.3	1.2
Blackjack Oak (<i>Q. marilandica</i> Muenchh.)	10.2	
White Oak (<i>Quercus alba</i> L., <i>Q. michauxii</i> Nutt.)	10.0	1.5
Sweet Gum (<i>Liquidambar styraciflua</i> L.)	3.1	6.0
Pin Oak (<i>Quercus phellos</i> L., <i>Q. nigra</i> L., <i>Q. laurifolia</i> Michx., <i>Q. texana</i> Buckl.)	1.6	0.9
Dogwood (<i>Cornus florida</i> L.)	1.3	
Ash (<i>Fraxinus pennsylvanica</i> Marsh)	0.7	10.0
Elm (<i>Ulmus americana</i> L.)	0.6	6.2
Willow (<i>Salix nigra</i> Marsh)		16.3
Hackberry (<i>Celtis laevigata</i> Willd.)		11.8
Cottonwood (<i>Populus deltoides</i> Bart. ex Marsh.)		9.1
Cypress (<i>Taxodium distichum</i> (L.) L. Rich.)		7.0
Box Elder (<i>Acer negundo</i> L.)		5.1
Locust (<i>Gleditsia triacanthos</i> L.)		4.7
Sycamore (<i>Platanus occidentalis</i> L.)		4.6
Tupelo Gum (<i>Nyssa aquatica</i> L.)		2.5
Persimmon (<i>Diospyros virginiana</i> L.)		1.5
Pecan (<i>Carya illinoensis</i> (Wang.) K. Koch)		1.3
Oak (<i>Quercus</i> species not designated)		1.1
Mulberry (<i>Morus rubra</i> L.)		0.9
Overcup Oak (<i>Quercus lyrata</i> Walt.)		0.8
Red Elm (<i>Ulmus rubra</i> Muhl.)		0.7
Privet (<i>Forestiera acuminata</i> (Michx.) Poir.)		0.7
Sassafras (<i>Sassafras albidum</i> (Nutt.) Nees)		0.6
Other	3.2	2.2
Total	100.0	100.0

4. In the 1830s, on the floodplain, oak and hickory were found to occur mainly in and around the Caddo Prairies in northern Caddo Parish. These long vanished prairies were briefly described by Freeman and Custis in 1806, but Anglo-American settlement soon erased all evidence of them (Flores 1984; MacRoberts et al. 1997). What these prairies were like will, unfortunately, remain a mystery; the two plants collected from them by Peter Custis in 1806 (*Veronicastrum virginicum* (L.) Farw. and *Eustoma russellianum* (Hook.) G. Don) have never been found in the region again (MacRoberts and MacRoberts 2004).

Surveyors' line notes mention "small cane" being present, and that the prairies were "dry and rich;" the soil was "black and first quality." This condition contrasts markedly with the surrounds, which were described as "overflow land," and "inundated." Additionally, the difference is marked by the fact that by 1838—a year after the Great Raft had been first cleared—there was a "cotton field," "corn field," "Scott's Improvement," "Scotts field," and "Hamilton's Farm" in Caddo Prairie. These were the only fields, farms, or "improvements" in the entire Township, indicating that natural prairies were a very different habitat than characterized surrounding areas. These prairies appear to have been an atypical part of the floodplain—they were on higher elevations, had different soil, and were open as indicated by the number of times the surveyors had to construct a mound for lack of trees to mark corners. This topography and soil difference probably accounted for the oaks and hickories.

DISCUSSION

We found that the woody vegetation of the Caddo Parish floodplain and upland is different. There is virtually no overlap in tree species today nor was there 170 years ago.

Upland forest structure of Caddo Parish appears to have been mixed oak-hickory and mixed oak-pine-hickory savanna/forest. The GLO surveys (both bearing trees and line notes) show that there were only a few areas of the Caddo Parish upland that were dominated by pine and probably none where pine alone dominated. Other areas were hardwood dominated, and this undoubtedly was the more characteristic canopy structure for the entire region, both east and west of the Mississippi River (Skeen et al. 1993; Dale and Ware 1999), notably where the fire return interval was less frequent than further south (Frost 1998).

A comparison of our Caddo Parish surveyors' record results with those of Bragg (2002, 2003) and Williams (1993) for the upland areas of Ashley and Union counties, southern Arkansas, and Williams and Smith (1995) for the Caney Ranger District in north central Louisiana, supports this conclusion. Bragg found oak, pine, and hickory in about the same proportions as we did. Williams (1993) found pine to vary from 51 percent to 4 percent depending on landform, and Williams and Smith found pine only slightly better represented than it is in Caddo Parish but with oak again dominant. Thus, at the time of Anglo-American settlement, pine was probably not as common as it is today (Skeen et al. 1993; Bragg 2003) and was definitely less common overall than oak.

These findings contrast markedly with the GLO survey records for areas with monospecific pine savanna/forest such as within the longleaf pine region of central Louisiana (Bridges & Orzell 1989). On the 182 sq. km Vernon Ranger District of the Kisatchie National Forest, 95 percent of the bearing trees were pine and only along stream courses were there hardwoods and cypress. Pine was the only bearing tree in the upland areas (Grace & Smith 1995; see review

by Platt 1999). Historical documents describe monospecific pine savanna/forest for the upper West Gulf Coastal Plain (Hilgard 1873; Lockett 1876; Mohr 1898; Mattoon 1915; see review in Bragg 2002), but the surveyor's notes for such areas have not been analyzed to see how they compare with other pine-dominated savanna/forest.

Our floodplain findings are also somewhat unusual. We had expected oak to be common—notably flood tolerant species. Except in the vicinity of Caddo Prairies, this was not the case. Oak was virtually absent from the floodplain. While there were distinct communities such as cypress swamps, oxbows, and others, the vegetation in general was what has been described as “Batture” or “*Populus deltoides* temporary flooded forest alliance” (Louisiana Natural Heritage 1988; Weakley et al. 1998).

Bois d'arc (*Maclura pomifera*), which is now common on the floodplain, did not appear in the Tree Book and presumably was not present until recently (Weniger 1996; Schambach 2003), although Peter Custis reported a large bois d'arc at Natchitoches in 1806 (Flores 1984), and Chinese tallow tree (*Sapium*) is now ubiquitous in the floodplain, as it is over so much of the south (Bruce et al. 1997).

The floodplain vegetation of the Red River has not been studied. Ours is the first study to use the original Government Land Office records to reconstruct reference conditions. Caddo Parish consists of only a fraction of the Red River floodplain, and until the surveyors notes are fully studied along the entire course of the river, generalizations are not possible. Nonetheless, on the basis of our road surveys, it looks like oak is largely missing from the lower stretches of the floodplain, at least from Natchitoches north to Arkansas. This situation may not prevail north of the Arkansas line. Palmer (1923) described the Red River forest at Fulton, Arkansas and found a combination of plant associations that closely parallels those described in textbooks (e.g., Sharitz & Mitsch 1993; Messina & Conner 1998; Mitsch & Grosselink 2000): cottonwood, sycamore, willow forests next to oak dominated bottomlands, next to cypress swamps, and so on.

APPENDIX 1

Since it has been suggested that there was sometimes bias in a surveyor's selection of bearing trees (Whitney & DeCant 2001; Bragg 2003), we checked for bias. We did this by comparing the frequency with which pine and oak was mentioned in the line notes with the frequency with which they were used as bearing trees in four townships that lacked or virtually lacked pine and two Townships that had the highest percentage of pine. We assumed that if pine or oak was being discriminated against, this would show up in the line notes where there was no reason to not mention a species. Except for pine in T17NR14-15-16W, we did not expect a close agreement of numbers since line notes and section and quarter section tree selection constitute two independent and very different

TABLE 2. Results of line notes comparison with bearing trees reported for T17NR14-15-16W and T23NR16W.

		Species		
		Pine	Oak	Other
T17NR14-15-16W				
Tree book	No.	32	570	187
	%	4	72	24
Surveyors' line notes	No.	24	200	200
	%	6	47	47
T23NR16W				
Tree book	No.	196	112	74
	%	51	29	19
Surveyors' line notes	No.	62	54	61
	%	35	31	33

sampling methods. Nonetheless, we did expect that line notes would not disagree totally with corner results, and they did not.

The results, given in Table 2, show that there is no reason to suppose bias. Line notes for the areas with high percentages of pine as a bearing tree most commonly read: "Timber oak & hickory & etc.," "oak & etc.," and "oak & pine," "pine & oak." Where pine was absent, they read: "oak & hickory."

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